The vagueness measure: a new interpretation and an application to image thresholding

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Here, we introduce a new interpretation of the vagueness measure [1] and an application for this approach. The vagueness measure is a generalized fuzziness measure based on a class of fuzzy operators. These operators contitute a coherent system which is called Pliant system [2], a subclass of continuous-valued logic. In this class each operator is defined by one generator function. The new property of the vagueness measure proposed in this work is that if the vagueness measure is computed for the distribution function of a given population, the value obtained gives a similar characteristic as the standard deviation of the population. Based on this feature, a new global thresholding algorithm was developed that generalizes the idea of Otsu's optimality criterion by the means of continuous-valued logic. The advantage of this approach is that it can be tuned for different problems by applying the appropriate operators. The performance of this method is compared with other commonly used algorithms to validate the usefulness of the proposed approach. The method was applied to a set of synthetic images for the sake of objectivism and we give a real application example where it is a part of a segmentation algorithm which segments skin lesions in digital dermoscopy images. Although the purpose of this algorithm is to threshold a grayscale image, it can be generalized for other tasks that require the separation of two or more populations, characterized by real values.

Acknowledgements

This study was partially supported by the TÁMOP-4.2.1/B-09/1/KONV-2010-0005 programme of the Hungarian National Development Agency.

References

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